

Comparison of ICG Angiography and Intra-operative Digital Subtraction Angiography to Post-operative Angiography in Brain AVM Surgery

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Introduction

The potential utility of microscope integrated indocyanine green(ICG)fluorescence angiography and intraoperative digital subtraction angiography in the setting of brain arteriovenous malformation(AVM) surgery is debatable. Post-operative angiogram is considered the gold standard. We evaluated the value of ICG and intra-operative angiography in assessment of AVM resection.

Methods

Between February 2010 to March 2013, 32 patients with brain AVM underwent surgical resection of their vascular lesions. ICG videoangiography and intraoperative angiogram were performed in all cases and a routine post-operative angiogram was done within 24-96 hours after surgery.

The ability to confirm total resection and to identify residual nidus or persistent shunt was assessed based on ICG angiographic findings and compared to intra-operative and post-operative digital subtraction angiography, respectively.

Results

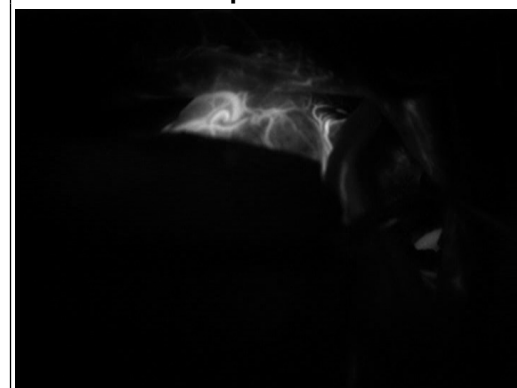
There were 16 grade A, 12 grade B and 4 grade C modified Spetzler classification AVMs. ICG angiography helped to distinguish AVM vessels in 25 patients. In 31 patients, it demonstrated that there is no residual shunting. In one patients, a residual AVM was identified, and further resected. Intra-operative angiogram detected 2 additional small residuals that were missed by ICG angiography, both deep in the surgical cavity. One was a grade B and the other a grade C. Further resection of the AVM was performed and total resection was confirmed by repeat intra-operative angiogram. No complication was occurred due to ICG or intra-operative angiography.

Post-operative angiogram in a patient with grade C lesion, revealed one additional small deep residual AVM nidus with persistent late shunting missed on both ICG and intra-operative angiography. Overall ICG angiography missed 3 out of 4(75%) residual AVM after initial resection, while intra-operative angiogram missed 1(25%).

Conclusions

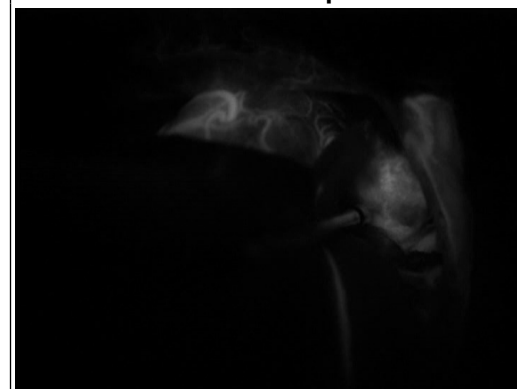
Although ICG angiography is a helpful adjunct in brain AVM surgery, its yield in detecting residual nidus or shunt is low, especially for deep seated residual AVMs and higher grade, therefore ICG angiography can not be used as a sole and/or reliable technique. Intra-operative angiogram has a higher reliability and should be strongly considered in brain AVM surgery. For complex and higher grade AVMs, however, a post-operative digital subtraction angiogram remains the best test to confidently confirm AVM total resection.

Intraoperative ICG



Example of en passage vessel on the lower right corner after total resection of an AVM

Post resection intraoperative ICG



Example of tiny residual in the surgical bed after presumed total resection of a grade B AVM